



(12) **United States Patent**
Smyers et al.

(10) **Patent No.:** **US 9,108,776 B2**
(45) **Date of Patent:** **Aug. 18, 2015**

(54) **LID, AND CONTAINER SYSTEM AND LID**

(71) Applicant: **WKI Holding Company, Inc.**,
Rosemont, IL (US)

(72) Inventors: **Justin Smyers**, Newport Beach, CA
(US); **Nicolsson Fernandes**, Ontario
(CA); **Steven M. Grider**, West Dundee,
IL (US); **Ken S. Tran**, West Covina, CA
(US)

(73) Assignee: **WKI Holding Company, Inc.**,
Rosemont, IL (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/754,773**

(22) Filed: **Jan. 30, 2013**

(65) **Prior Publication Data**

US 2013/0233854 A1 Sep. 12, 2013

Related U.S. Application Data

(60) Provisional application No. 61/609,142, filed on Mar.
9, 2012.

(51) **Int. Cl.**
B65D 53/00 (2006.01)
B65D 43/02 (2006.01)
B65D 53/06 (2006.01)

(52) **U.S. Cl.**
CPC **B65D 53/00** (2013.01); **B65D 43/0212**
(2013.01); **B65D 53/06** (2013.01); **B65D**
2543/00027 (2013.01); **B65D 2543/0074**
(2013.01); **B65D 2543/0099** (2013.01); **B65D**
2543/00194 (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC .. B65D 43/065; B65D 43/06; B65D 43/0212;

B65D 53/06; B65D 53/00; B65D 45/04;
B65D 45/18; B65D 45/16; B65D 45/22;
B65D 2543/0099; B65D 2543/00953
USPC 220/780, 784, 795
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,542,115 A 6/1925 Weis
3,117,692 A 1/1964 Carpenter et al.
(Continued)

FOREIGN PATENT DOCUMENTS

DE 19526719 1/1997
DE 19543388 5/1997
DE 20320088 6/2005

OTHER PUBLICATIONS

Notification of Transmittal of the International Search Report and the
Written Opinion of the International Searching Authority, mailed
Sep. 25, 2013, re International Application PCT/US2013029724, 16
pages.

Primary Examiner — Anthony Stashick

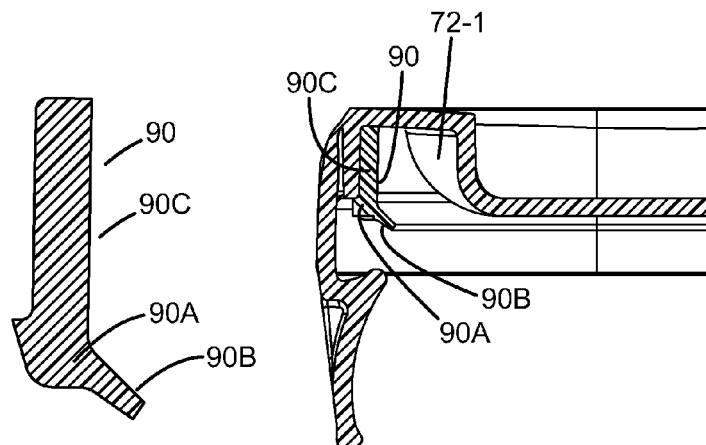
Assistant Examiner — James Way

(74) *Attorney, Agent, or Firm* — Larry K. Roberts

(57) **ABSTRACT**

In one embodiment, a lid structure with latches is configured
for sealing use with container vessels of different materials
having differing manufacturing dimensional tolerances, such
plastic vessels and glass vessels. Another feature of a lid and
vessel combination is the provision of a lid receptacle feature,
configured to capture the base of a vessel in a stacking
arrangement, without utilization of special features on the
vessel base. Another feature of an embodiment of a lid is the
capability of lid nesting of multiple lids with interference fit
between adjacent lids to lock the lids together.

18 Claims, 18 Drawing Sheets



(52) U.S. CL.

CPC B65D 2543/00296 (2013.01); B65D
2543/00527 (2013.01); B65D 2543/00537
(2013.01); B65D 2543/00564 (2013.01); B65D
2543/00629 (2013.01); B65D 2543/00685
(2013.01); B65D 2543/00805 (2013.01); B65D
2543/00842 (2013.01)

(56)

References Cited

U.S. PATENT DOCUMENTS

3,409,123 A 11/1968 McCormick
3,797,694 A 3/1974 See et al.
3,800,972 A 4/1974 Raymond
4,206,845 A 6/1980 Christian
4,482,077 A 11/1984 Henderson
4,494,674 A 1/1985 Roof
4,501,378 A 2/1985 Berfield
4,512,498 A 4/1985 Leibinger
4,562,047 A 12/1985 Sestak et al.
4,702,389 A 10/1987 Bozinovich et al.
4,703,857 A 11/1987 Jahn et al.
4,795,056 A 1/1989 Meyers
4,936,483 A 6/1990 Ballu
4,951,832 A 8/1990 Tenney et al.
4,971,774 A 11/1990 Schwanke et al.
5,016,756 A 5/1991 Wischhusen et al.
5,115,934 A 5/1992 Nelson
5,116,240 A 5/1992 Wischhusen et al.
5,184,745 A 2/1993 Havens et al.
5,225,125 A * 7/1993 Wildfeuer et al. 264/46.6
5,356,026 A 10/1994 Andress et al.
5,377,860 A 1/1995 Littlejohn et al.
5,409,128 A 4/1995 Mitchell
5,586,656 A 12/1996 Abrums
5,641,065 A * 6/1997 Owens et al. 206/370
5,692,617 A 12/1997 Adams
5,699,925 A 12/1997 Petrucci
5,769,229 A 6/1998 Andress et al.
5,799,792 A 9/1998 Abrums
5,868,273 A * 2/1999 Daenen et al. 220/795
5,944,211 A 8/1999 Woodnorth et al.
6,129,234 A 10/2000 Culig et al.
6,170,691 B1 1/2001 Morris, Sr. et al.

6,170,696 B1 1/2001 Tucker et al.
6,343,708 B1 2/2002 Riso
6,729,472 B2 5/2004 Stucke et al.
D493,335 S 7/2004 Armato
6,793,096 B1 9/2004 Seok
6,796,430 B2 9/2004 Mercier et al.
D501,764 S 2/2005 Lerner
D503,872 S 4/2005 Armato
6,910,599 B2 6/2005 Tucker et al.
7,097,067 B2 8/2006 Scarabelli et al.
7,261,219 B2 8/2007 Tucker et al.
7,510,096 B2 3/2009 Wang
7,594,586 B2 9/2009 Cai
7,621,417 B2 11/2009 Peterson et al.
7,726,483 B2 6/2010 Ramanujam et al.
2002/0148846 A1 * 10/2002 Luburic 220/792
2003/0019878 A1 1/2003 Scarabelli et al.
2003/0116572 A1 6/2003 Klock et al.
2005/0045628 A1 3/2005 Chan
2006/0027588 A1 2/2006 Mackovic-Basic et al.
2006/0070907 A1 4/2006 O'Shea
2006/0261065 A1 11/2006 Claypool et al.
2007/0119743 A1 5/2007 Tucker et al.
2007/0187277 A1 8/2007 Furlong
2007/0284276 A1 12/2007 Luttik et al.
2008/0000795 A1 1/2008 Deakin et al.
2008/0105684 A1 5/2008 Lindsay
2009/0000977 A1 1/2009 Coonce
2009/0008284 A1 1/2009 Lown et al.
2009/0026205 A1 1/2009 Moon
2009/0078715 A1 3/2009 Kim
2009/0084796 A1 4/2009 Coonce et al.
2009/0166369 A1 7/2009 Savicki
2009/0173656 A1 7/2009 Furlong
2009/0206080 A1 8/2009 Ribi
2009/0223986 A1 9/2009 Song
2010/0065461 A1 3/2010 Chhay
2010/0170204 A1 7/2010 Althimer
2010/0170824 A1 7/2010 Ramanujam et al.
2010/0176022 A1 7/2010 Furlong
2010/0200588 A1 8/2010 Bergman et al.
2010/0237070 A1 * 9/2010 Coonce et al. 220/203.29
2011/0031705 A1 * 2/2011 Peddle et al. 277/650
2011/0163099 A1 7/2011 DiPietro et al.

* cited by examiner

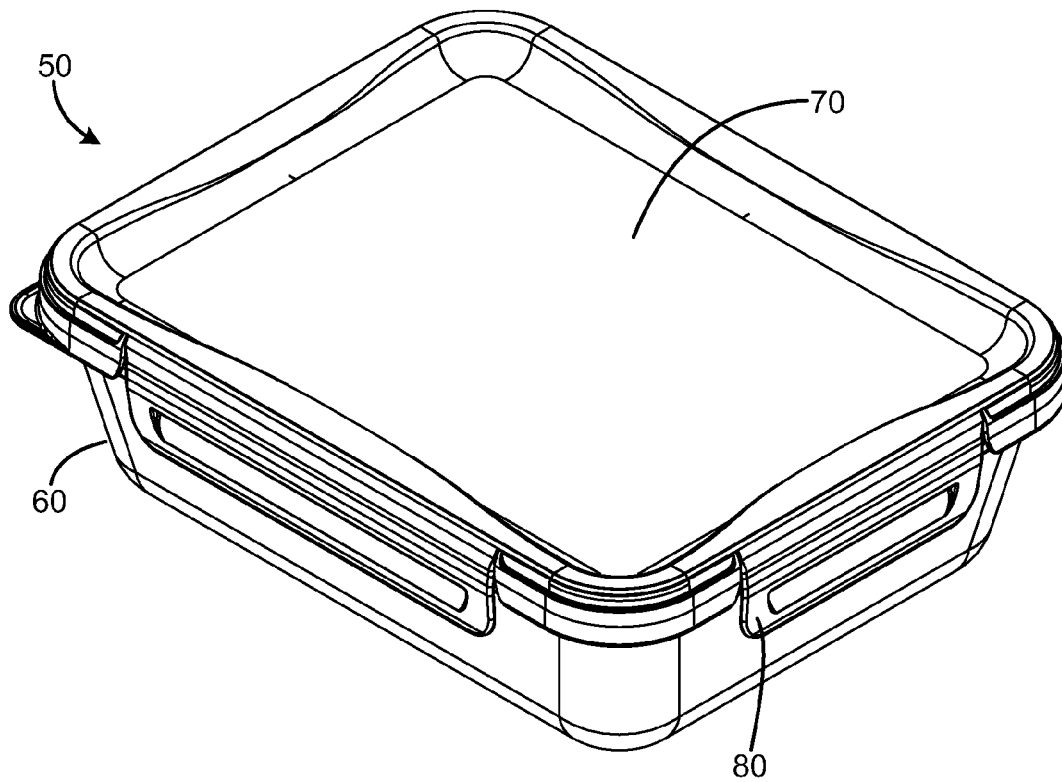


FIG. 1A

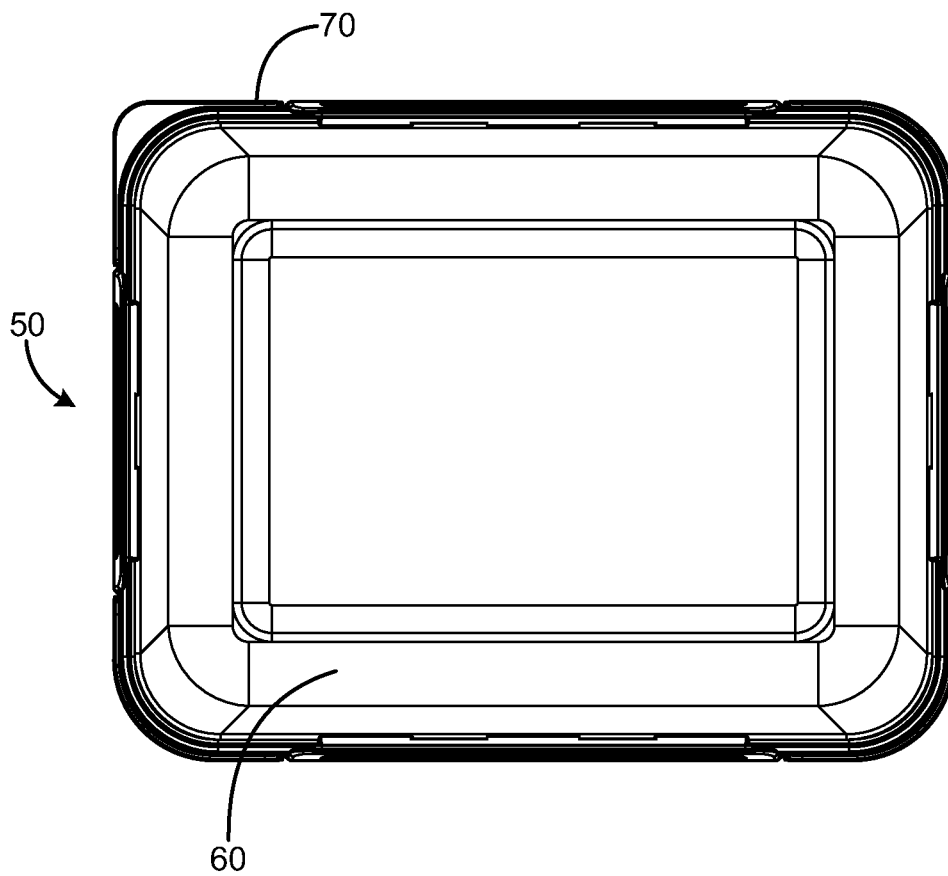


FIG. 1B

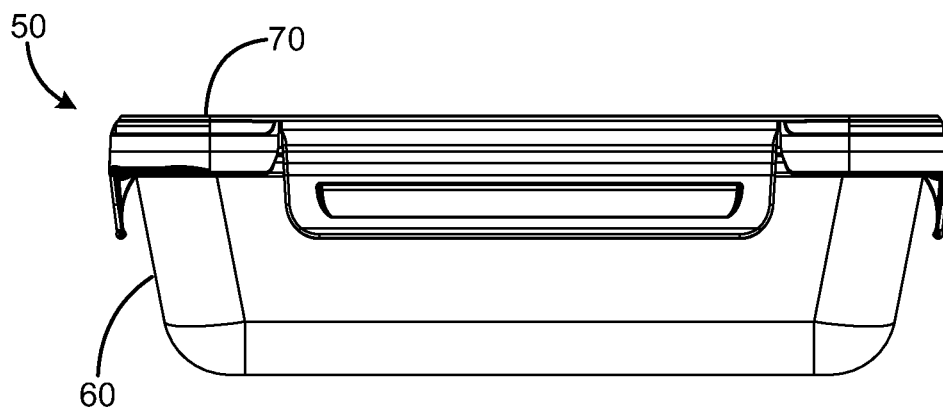


FIG. 1C

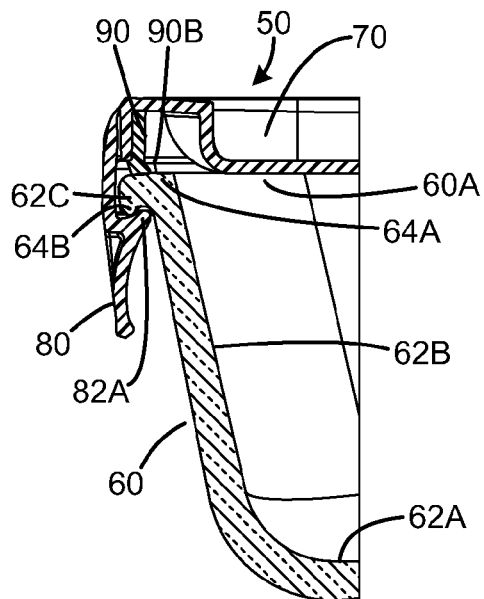


FIG. 2B

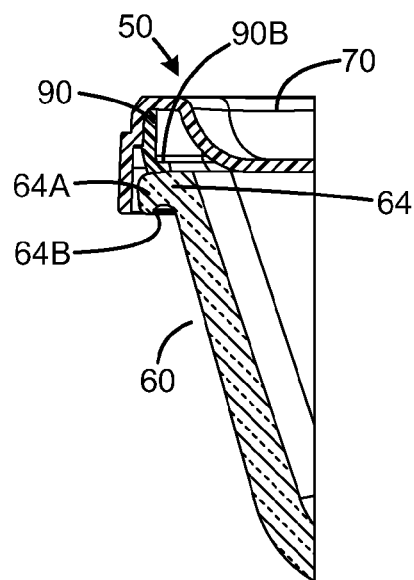


FIG. 2C

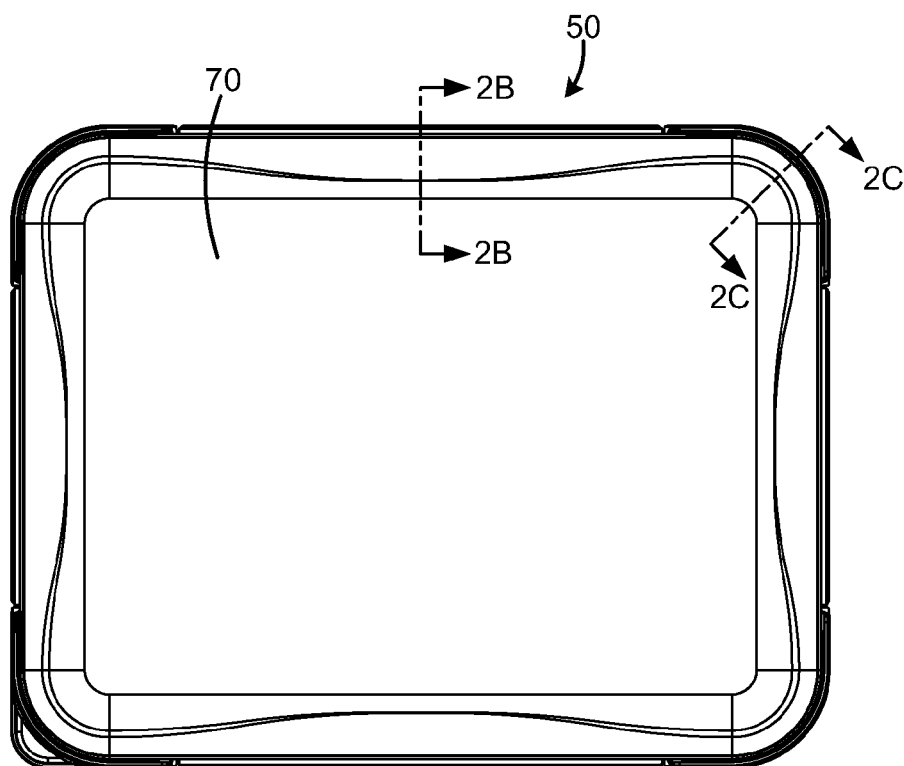


FIG. 2A

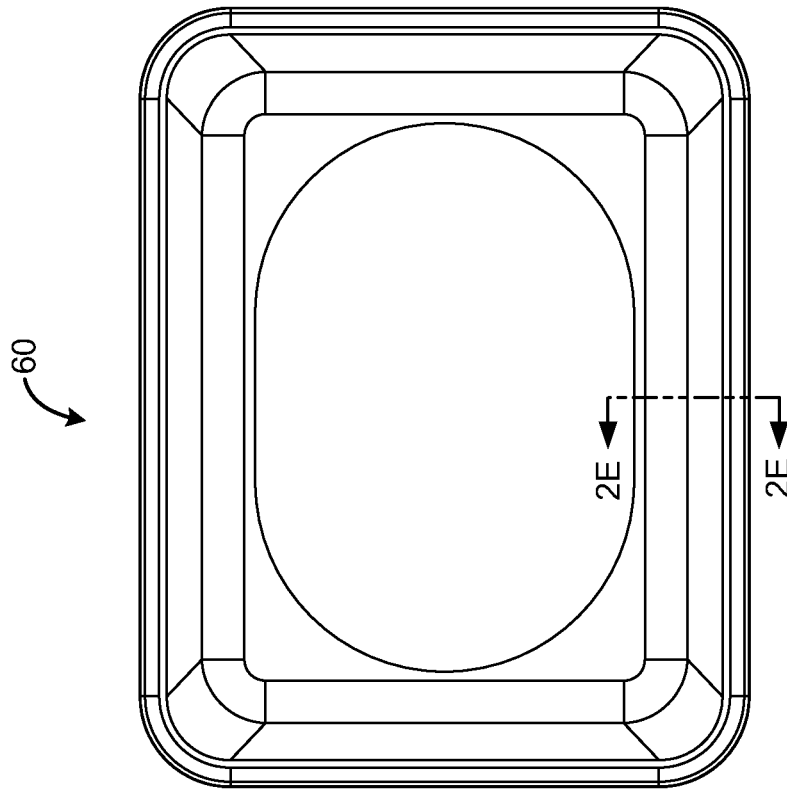


FIG. 2D

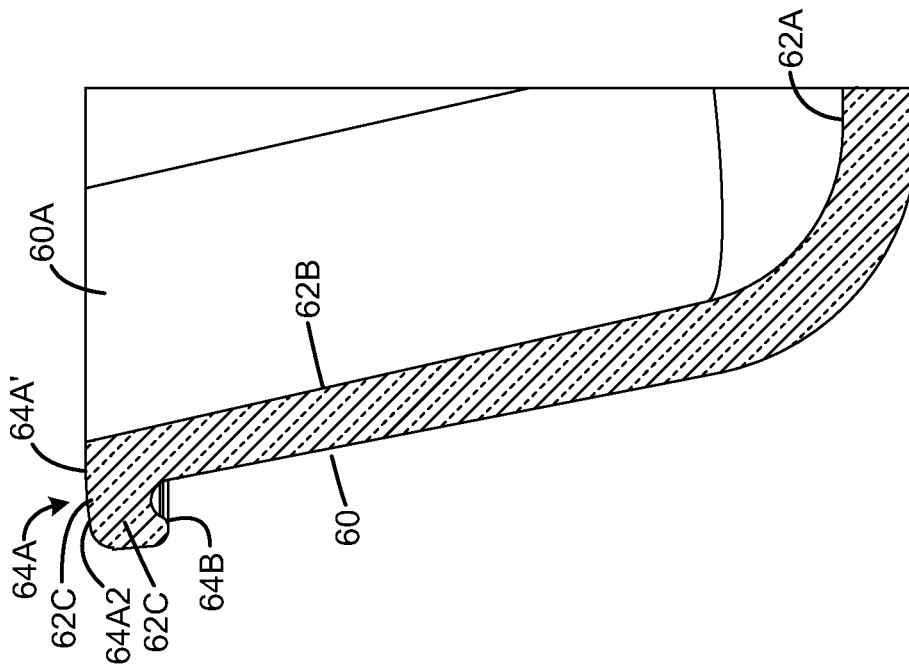
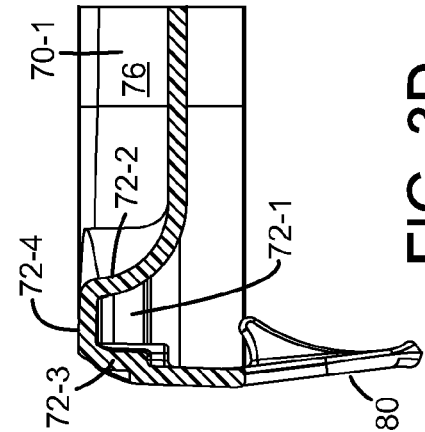
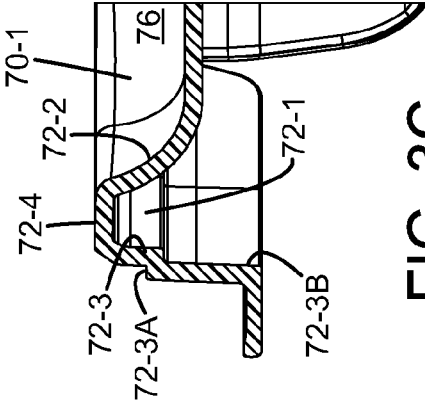
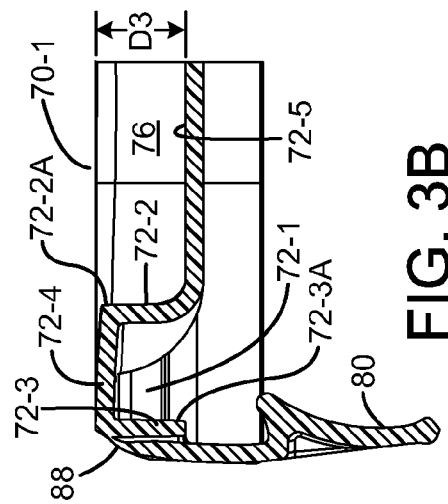
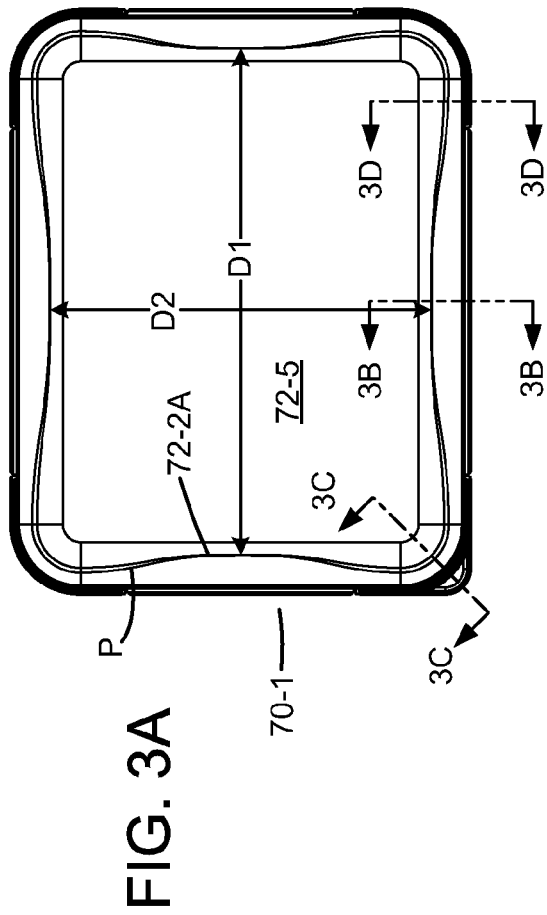


FIG. 2E



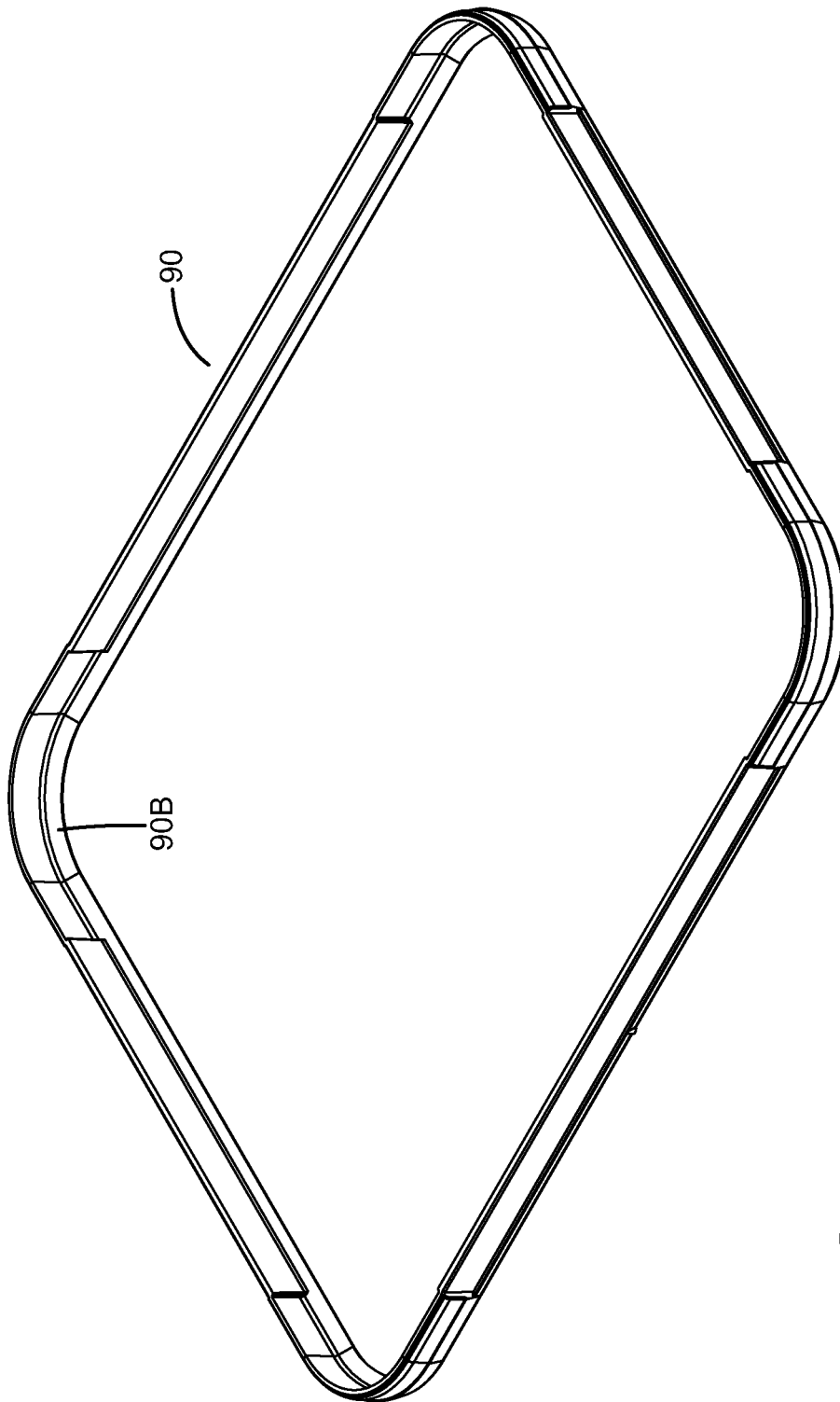


FIG. 4

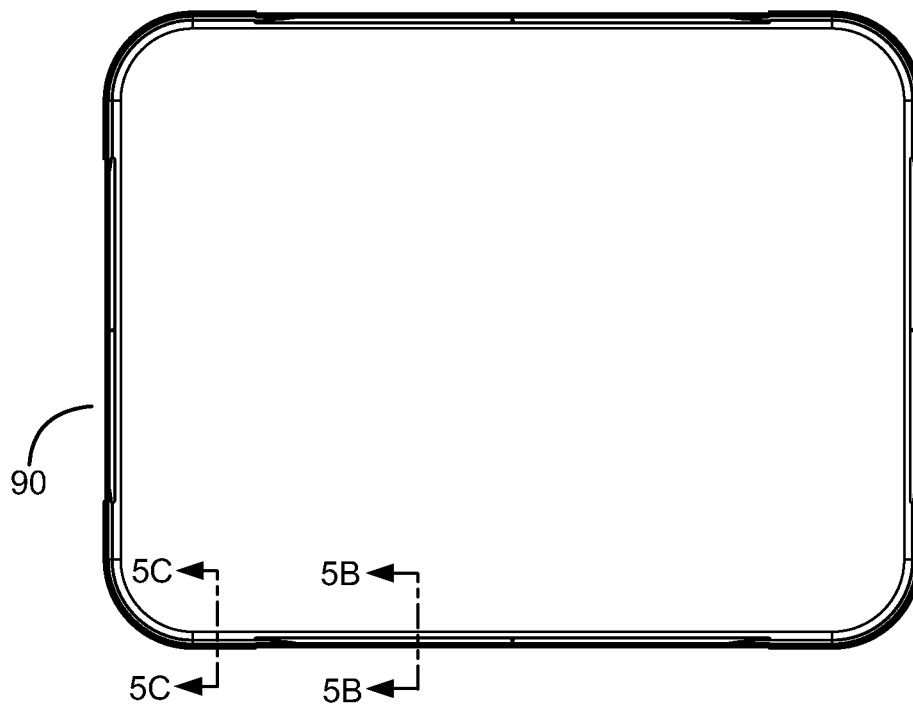


FIG. 5A

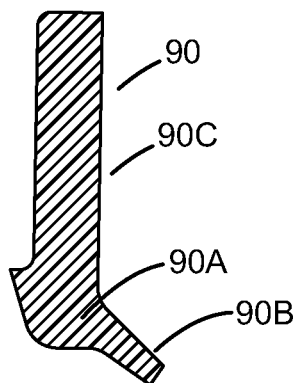


FIG. 5B

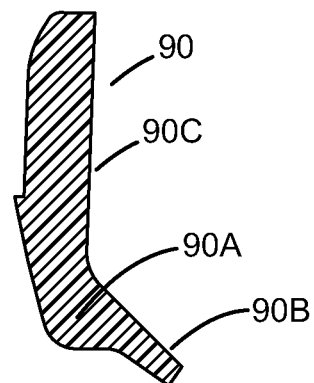


FIG. 5C

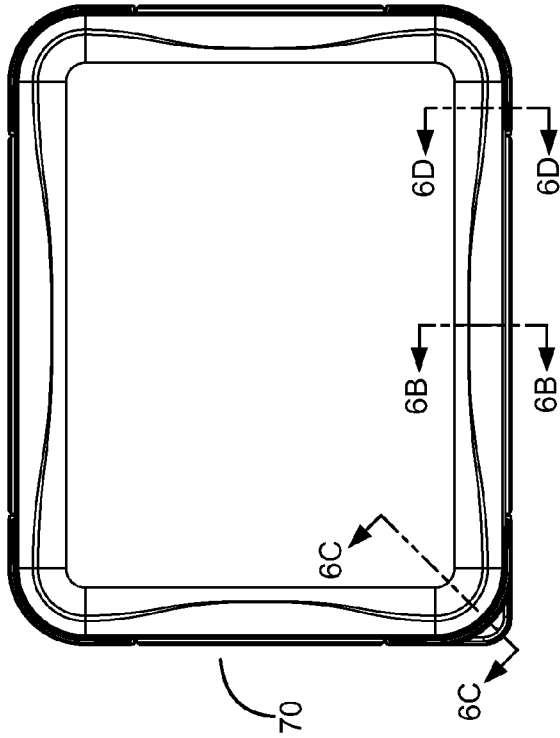


FIG. 6A

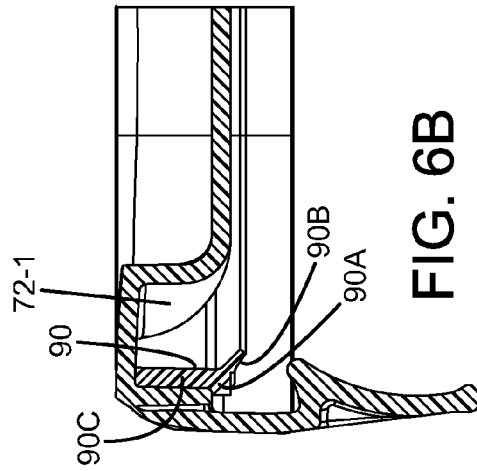


FIG. 6B

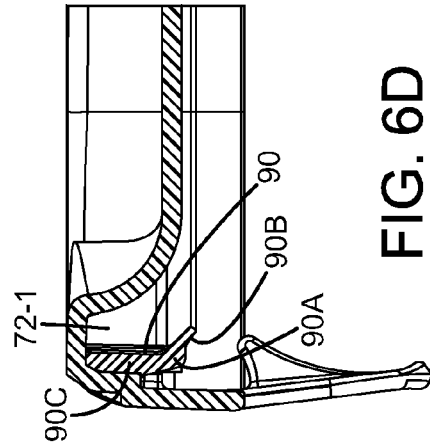


FIG. 6D

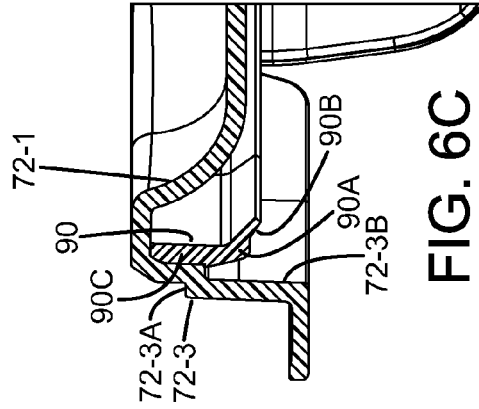


FIG. 6C

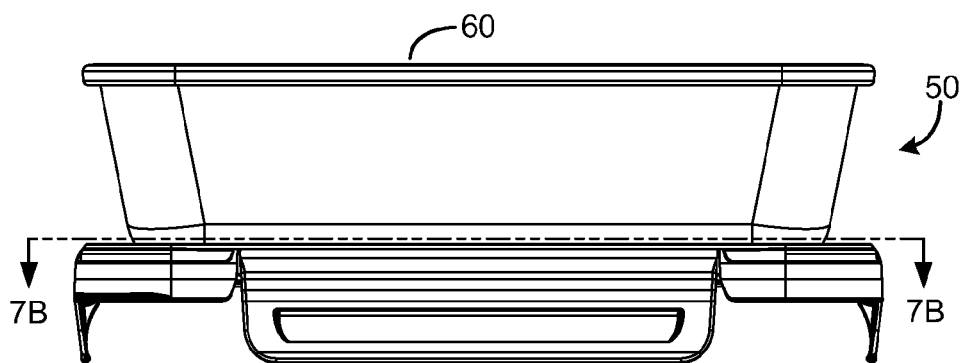


FIG. 7A

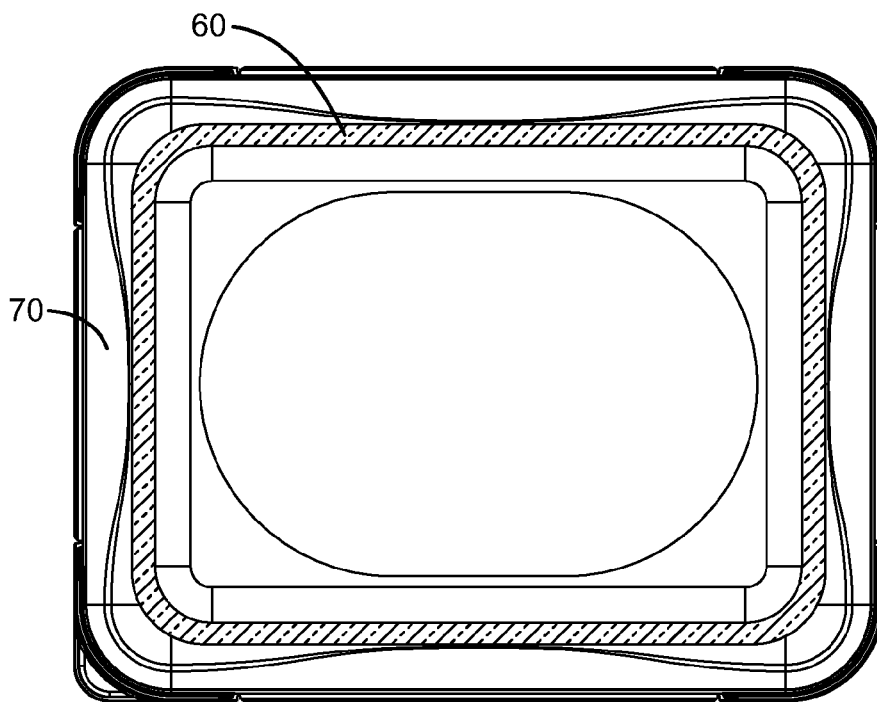


FIG. 7B

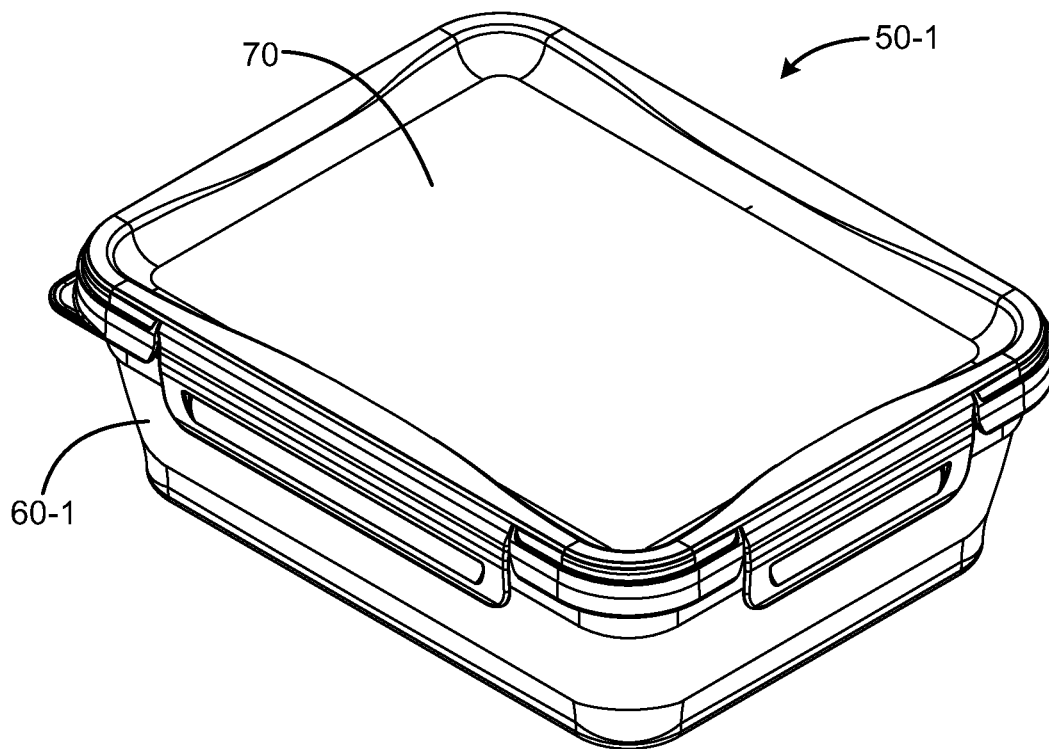


FIG. 8A

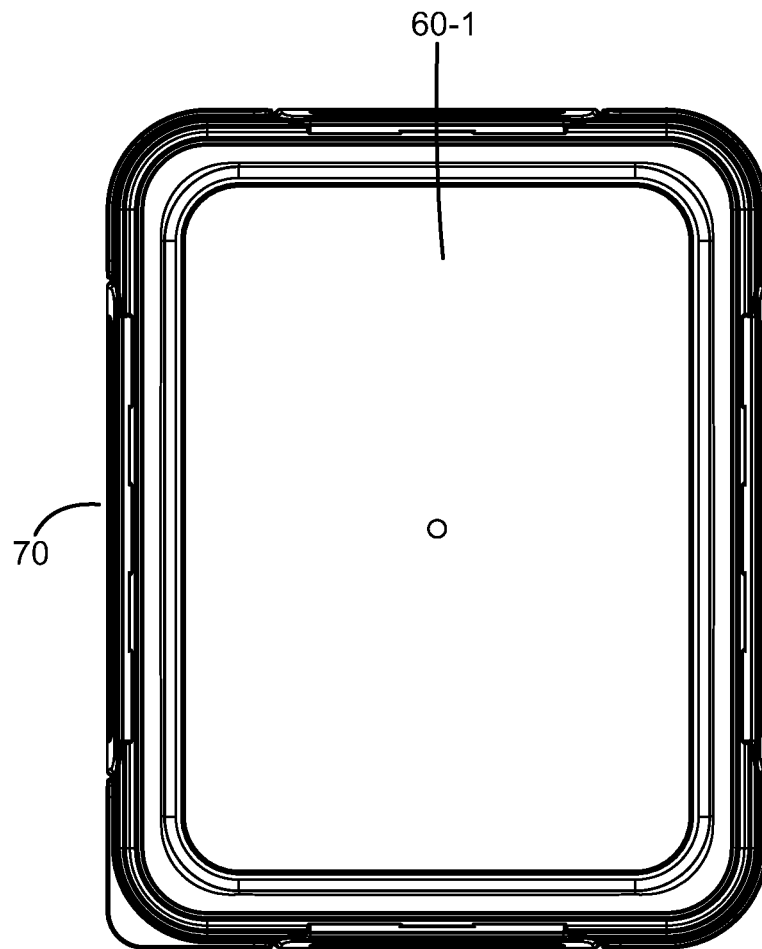


FIG. 8B

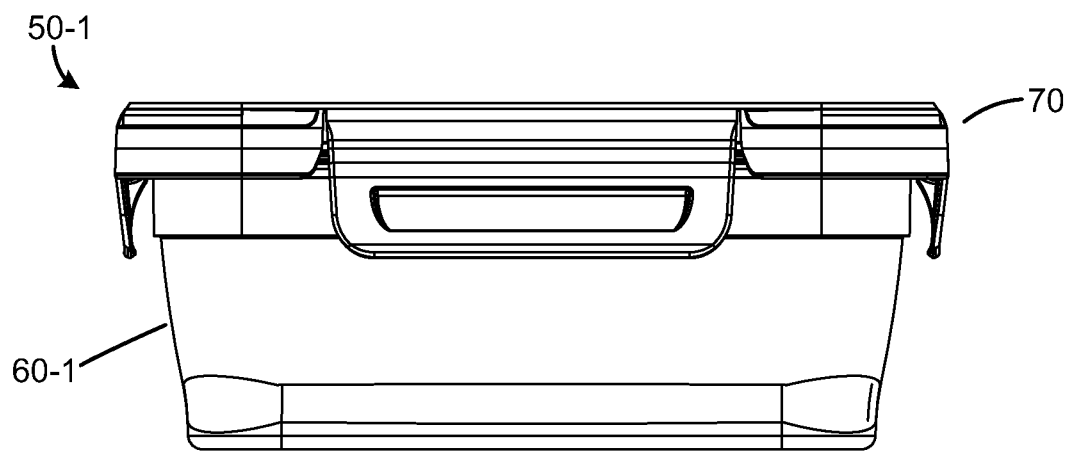


FIG. 8C

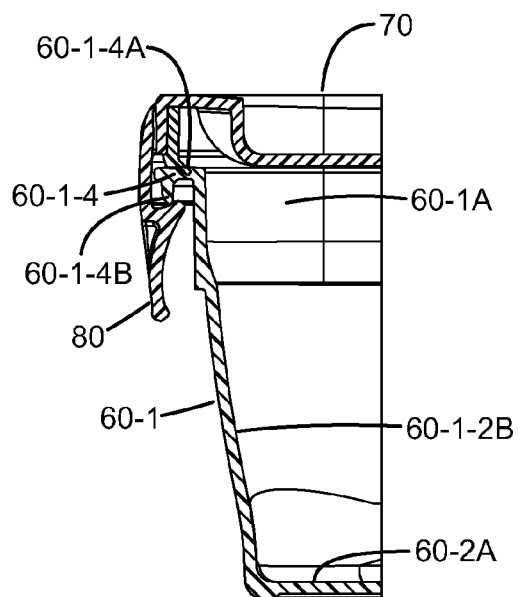


FIG. 9B

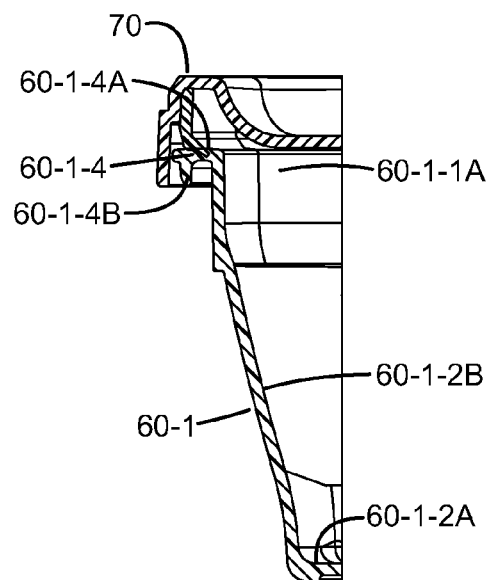


FIG. 9C

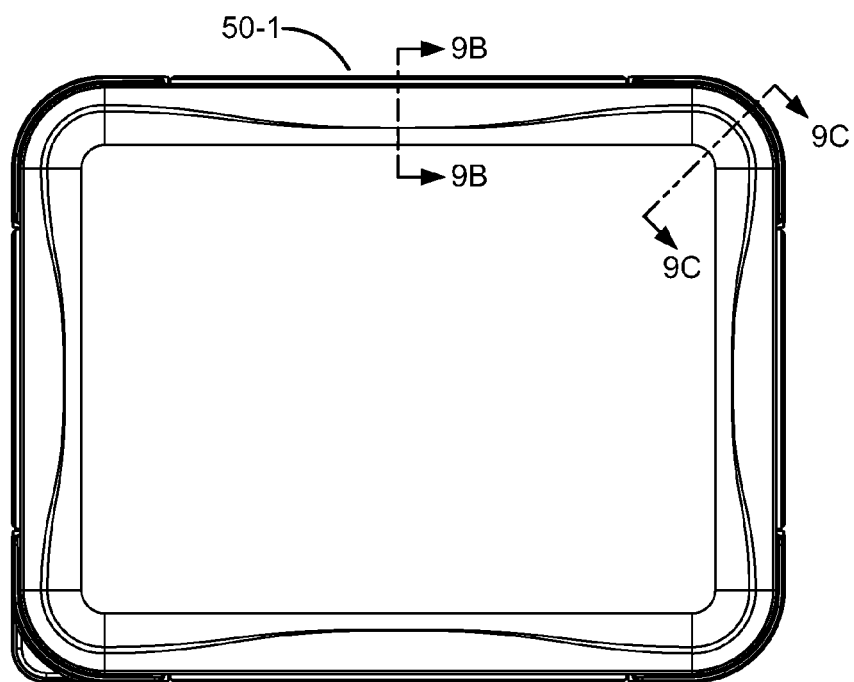


FIG. 9A

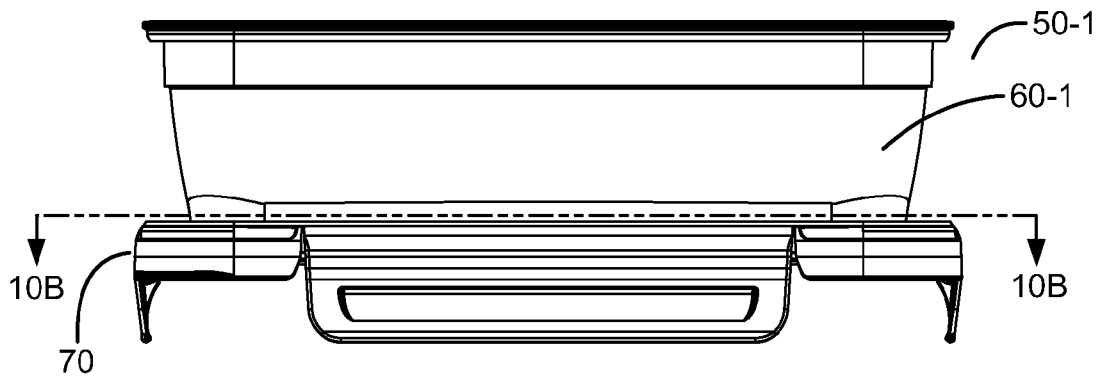


FIG. 10A

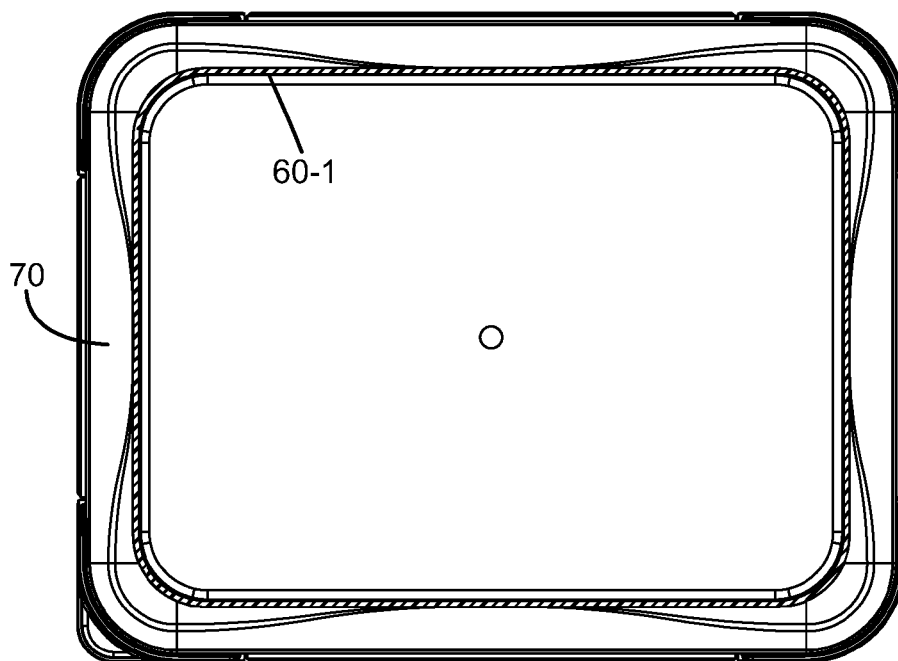


FIG. 10B

FIG. 11A

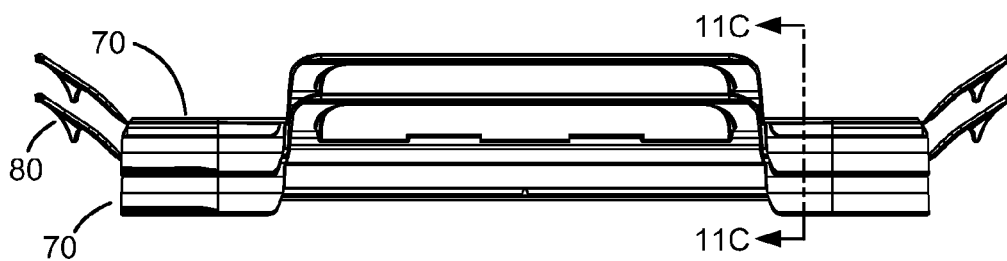
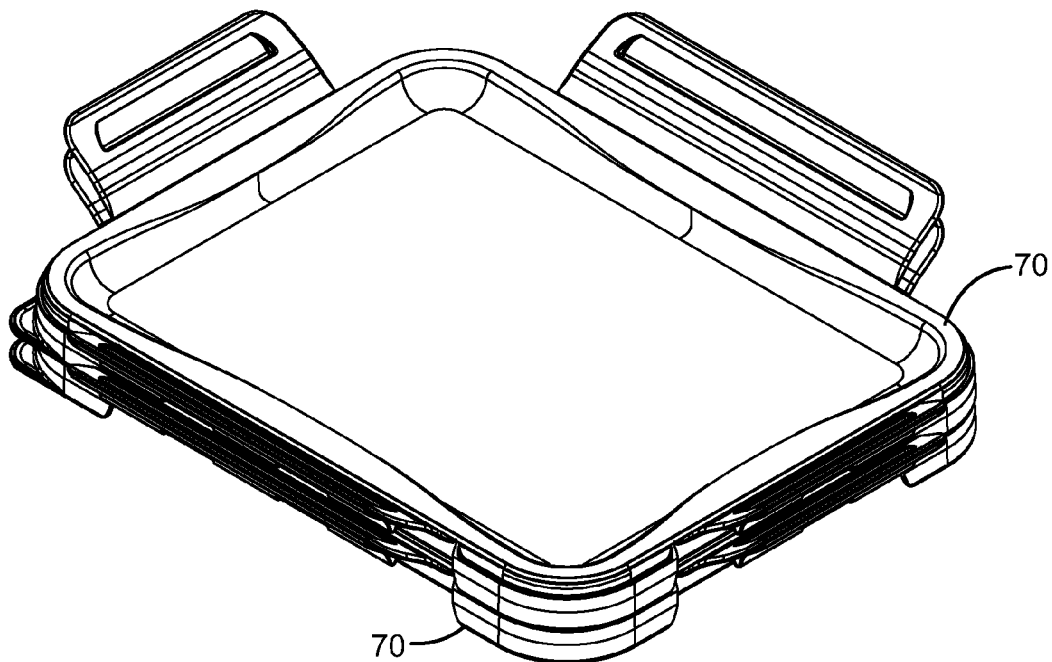


FIG. 11B

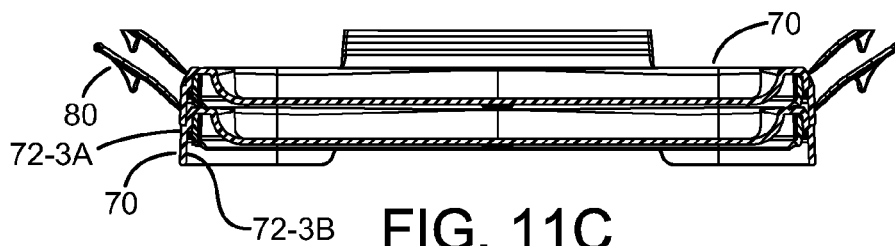


FIG. 11C

FIG. 12A

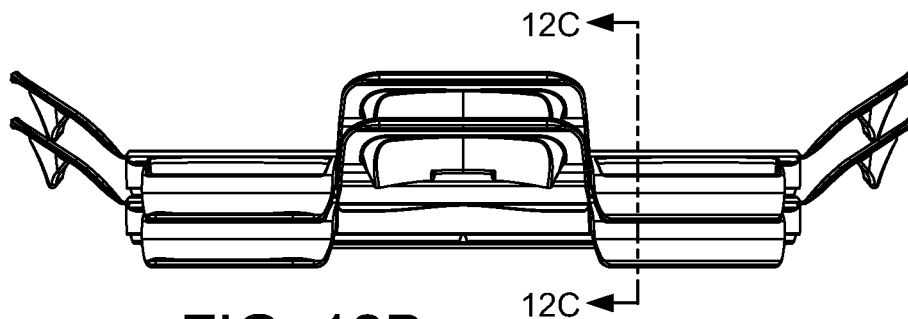
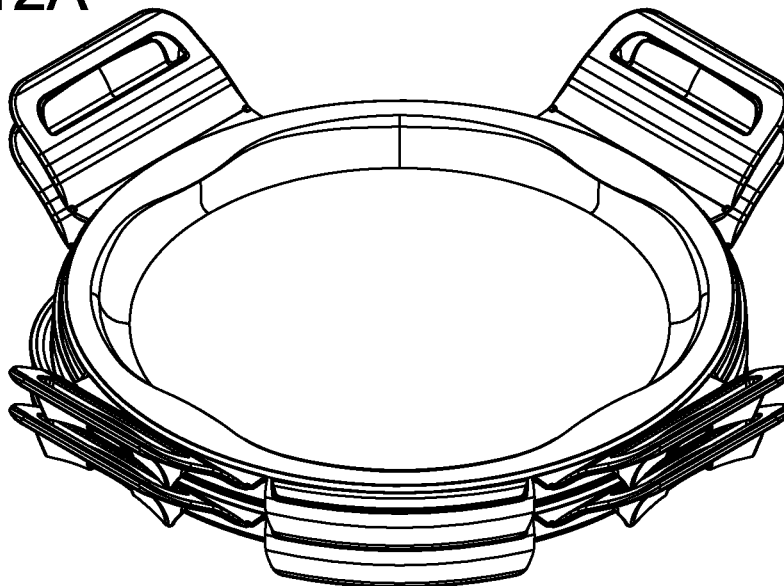


FIG. 12B

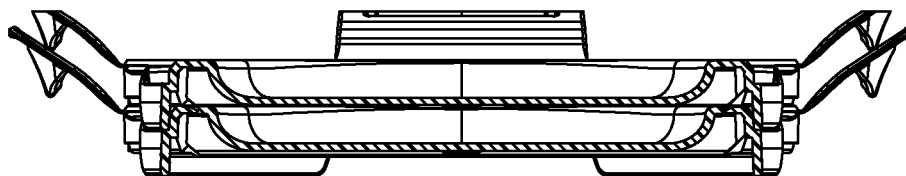


FIG. 12C

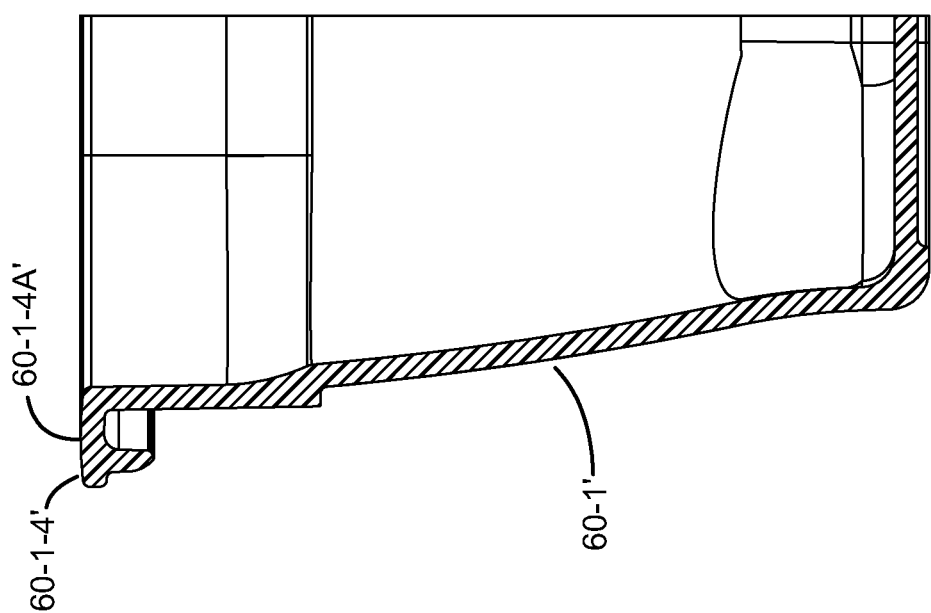


FIG. 13A

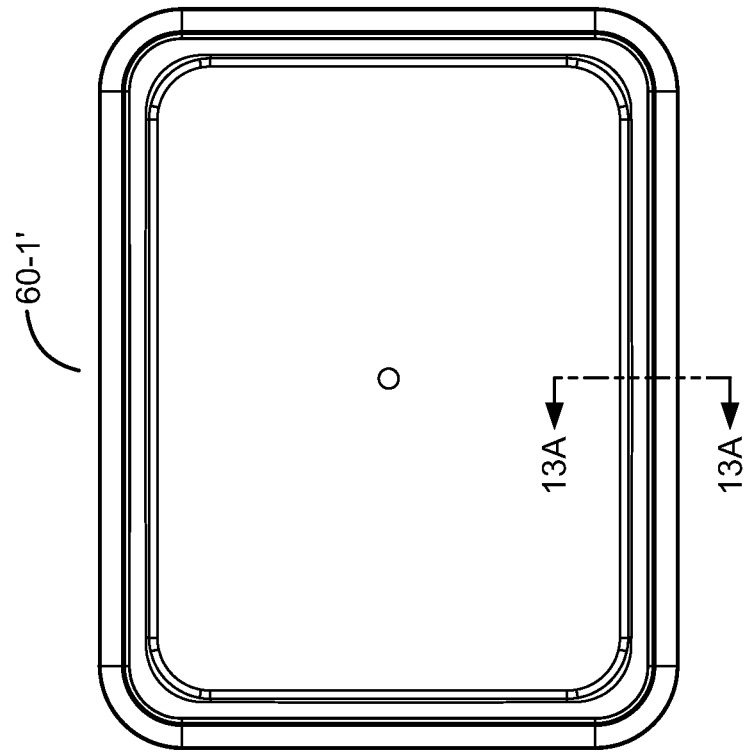


FIG. 13

1

LID, AND CONTAINER SYSTEM AND LID**CROSS-REFERENCE TO RELATED APPLICATION**

This application claims priority to U.S. Provisional patent application 61/609,142, filed Mar. 9, 2012, and entitled "Lid, and Container System and Lid."

BACKGROUND

Vessels for holding food items may include a separate lid, but are often not provided with an air-tight seal. This is particularly the case for glass vessels for example. Air-tight container-lid systems are typically fabricated from a rigid plastic material, and typically utilize a separate seal member disposed between the lid and container.

BRIEF DESCRIPTION OF THE DRAWINGS

Features and advantages of the disclosure will readily be appreciated by persons skilled in the art from the following detailed description when read in conjunction with the drawing wherein:

FIG. 1A is an isometric view of an exemplary embodiment of a container and lid system, in which the container is fabricated of a glass material. FIGS. 1B and 1C are respective bottom and end views of the container and lid system of FIG. 1A.

FIG. 2A is a top view of the container and lid system of FIG. 1A. FIGS. 2A and 2C are respective cross-sectional views taken through lines 2B-2B and 2C-2C of FIG. 2A. FIG. 2D is a top view of an exemplary embodiment of a glass vessel as in the system of FIG. 1A. FIG. 2E is a cross-sectional view taken along line 2E-2E of FIG. 2D.

FIG. 3A is a top view of an exemplary embodiment of a first shot structure of a lid structure of the system of FIG. 1A. FIGS. 3B, 3C and 3D are respective cross-sectional views taken through lines 3B-3B, 3C-3C and 3D-3D of FIG. 3A.

FIG. 4 is an isometric view of an exemplary embodiment of a second shot structure, a seal structure portion, of the lid structure of FIG. 1A.

FIG. 5A is a top view of the second shot portion of FIG. 4. FIGS. 5B and 5C are respective cross-sectional views of the second shot structure of FIG. 5A.

FIG. 6A is a top view of the lid structure of the system of FIG. 1A. FIGS. 6B, 6C and 6D are respective cross-sectional views taken along lines 6B-6B, 6C-6C and 6D-6D of FIG. 6A.

FIG. 7A is a side view of a container/lid system as in FIG. 1A, in which a container is in a stacking relationship to a lower lid. FIG. 7B is a cross-sectional view taken along line 7B-7B of FIG. 7A.

FIG. 8A is an isometric view of an exemplary embodiment of a container and lid system, in which the container is fabricated of a plastic material, and the lid is as described above regarding FIGS. 2A-7B. FIGS. 8B and 8C are respective bottom and front views of the container and lid system of FIG. 8A.

FIG. 9A is a top view of the container and lid system of FIG. 8A. FIGS. 9B and 9C are respective cross-sectional views taken through lines 9B-9B and 9C-9C of FIG. 9A.

FIG. 10A is a side view illustrating a stacking arrangement of a container lid system as in FIG. 8A, with the container in a stacking arrangement on a lower lid. FIG. 10B is a cross-sectional view taken along line 10B-10B of FIG. 10A.

2

FIG. 11A is an isometric view of an exemplary embodiment of a set of lids as in the system of FIG. 1A, in which the lids are in a lid stacking arrangement. FIG. 11B is an end view of the stacked lids of FIG. 11A. FIG. 11C is a cross-section view taken along line 11C-11C of FIG. 11B.

FIG. 12A is an isometric view of an exemplary embodiment of a set of lids for a circular container configuration, arranged in stacking relation. FIG. 12B is a side view of the stacked lids of FIG. 12A. FIG. 12C is a cross-section view of the stacked configuration of FIG. 12B, taken along line 12C-12C of FIG. 12B.

FIG. 13 is a top view of a plastic vessel. FIG. 13A is a cross-sectional view of the vessel of FIG. 13, taken along line 13A-13A of FIG. 13.

DETAILED DESCRIPTION

In the following detailed description and in the several figures of the drawing, like elements are identified with like reference numerals. The figures may not be to scale, and relative feature sizes may be exaggerated for illustrative purposes.

In accordance with one aspect, a lid structure with latches is configured for sealing use with container vessels of different materials having differing manufacturing dimensional tolerances, e.g. plastic, metal, glass and ceramic vessels. Plastic vessels can typically be manufactured to tighter tolerances than vessels of other materials such as glass and ceramic. For example, a glass or ceramic vessel may have a flat circumferential seal surface, whose flatness has a certain dimensional tolerance. Plastic or metal vessels can be manufactured with tighter tolerances, so that a similar flat circumferential seal surface can be expected to seal to a lid with greater seal effectiveness than can the glass or ceramic vessel. A lid with capability for use on a plurality of vessel types, i.e. a universal lid, provides significant advantages. For example, the lid may be sold to consumers separately from the vessel, allowing the user to purchase a separately sold vessel to be used with the lid. This provides the consumers with the capability to choose the vessel which best meets his or her needs, while still being able to use the same lid. Another advantage is that the number of types of lids which must be held in inventory by a merchandiser is reduced, since the same lid can be used with multiple types of vessels. Costs of production may be reduced, due to increased scale of production.

In accordance with another aspect, a lid configuration is provided with capability of stacking multiple lids together and with interference fitting of the adjacent lids, for maintaining the lid stack in place.

Another aspect is a lid and vessel configured to provide the capability of stacking the vessel on top of the lid, with an interference fit of lid features to the base of the vessel.

An exemplary embodiment of a vessel-lid combination includes a glass, ceramic, metal or plastic vessel having an open top surrounded by a peripheral edge, a lid fabricated of a plastic material, and a seal structure integrated with the lid to form a unitary structure. The lid is configured to attach to the open top by means of a latch or set of latches integrated with the lid, and the seal structure is configured to provide a substantially air-tight seal between the lid and the peripheral edge of the vessel when the lid is attached to the vessel. In one exemplary embodiment, the vessel is a container fabricated of a glass suitable for baking or oven heating applications. In another embodiment, the vessel is fabricated of a plastic material such as polypropylene. In a general sense the vessel could be any container with a suitable locking lip to engage the lid latches, including plastic, ceramic, metal, glass or

3

other containers. In an exemplary embodiment, a lid is configured for use on different vessels fabricated from dissimilar materials and with different manufacturing tolerances.

FIGS. 1A-7B illustrate an exemplary embodiment of a vessel and lid system 50, which includes a vessel 60 and a lid 70 with an integral seal structure and latches 80. The vessel 60 in one embodiment is a glass container, which may be suitable for heating or baking food items in a hot oven. In this embodiment, the vessel 60 is made from a material which can withstand oven temperatures and cooling stresses. Other types of glass, metal, ceramic or plastic vessels can be configured for use with the lid 70, such that the vessels are formed with a sealing edge and latch engagement lip, as described more fully below.

The cross-sectional views of FIGS. 2B and 2C illustrate the construction of the exemplary vessel 60 in further detail. The vessel 60 is a unitary structure, having an open top region 60A, defined by a bottom portion 62A, a sidewall portion 62B and a peripheral rim portion 64. A sealing edge portion 62C is defined by the sidewall portion at or adjacent the open top region. In this example, the sidewall portion 62B is angled outwardly from the bottom region, defining a 13.5 degree angle relative to the bottom portion. This particular angular arrangement is but one example, other configurations of the sidewall and bottom portions of the vessel may alternately be employed. The rim portion 64 includes a generally flat top edge portion 64A and a latch engagement lip portion 64B.

The lid 70 is attached to the vessel 60 and latched in place to cover the open vessel top, using latches 80 connected by living hinges to the lid proper on opposite sides of the lid. The latches have latch hook features 82A which engage the latch engagement lip portion 64B of the vessel when the lid is placed on the vessel and the latches rotated about the hinges to the latched position shown in FIGS. 1A and 2B, for example. A seal structure 90, discussed more fully below, engages a seal surface on the vessel, the top edge portion 64A, as the lid is latched in place.

The lid 70 in an exemplary embodiment is fabricated by injection molding using a two shot molding technique, in which a first shot structure is fabricated of a first plastic material, and then the lid structure is completed in a second shot in which a second plastic material is overmolded to a portion of the first shot structure to form the seal structure 90. The second plastic material is bonded to surfaces of the first shot material as a result of the molding process. FIGS. 3A-3D illustrate an exemplary embodiment of the first shot structure 70-1 of the lid 70. In an exemplary embodiment, the primary, first shot lid structure is formed from a polymer such as polypropylene or similar structurally rigid polymer material. FIG. 3D also illustrates that the latch 80 in the downward, latched condition, is recessed relative to the lid outer skirt, so that the latch and hinge do not protrude outwardly from the lid skirt, thus offering some protection against damage to the latch.

FIGS. 4 and 5A-5C illustrate an exemplary embodiment of the second shot structure, the seal structure 90, in isolation. An exemplary over-mold material used in the second shot is a thermoplastic elastomer (TPE) material. By fabricating the seal structure in this manner using an overmold, second shot process, several advantages are obtained, including lower cost relative to a separate, removable seal, cleanliness (by avoiding space between a removable seal and the lid structure), and ease of use since the seal structure is permanently attached to the first shot structure.

FIGS. 6A-6D illustrate an exemplary embodiment of the lid 70 in a completed form, i.e. after the overmolding process is completed to form the second plastic material to the first

4

shot structure and define the seal structure 90. In an exemplary embodiment, the first shot lid structure defines a peripheral channel 72-1 between a peripheral downwardly extending skirt portion 72-3 and an inner peripheral wall structure 72-2, connected by a web portion 72-4. The second shot material of the seal structure 90 in this embodiment is molded to the interior side wall 72-3A (FIG. 3B) of the skirt portion and to the web portion. In an exemplary embodiment, the second shot material does not fill the channel, but in other embodiments, the second shot material may fill a larger part or all the channel if desired for a particular application.

The seal structure 90 in this embodiment comprises several portions. A main body portion 90C is attached to the inner wall of the skirt and to the web portion. Another seal portion is a protruding spring portion 90B. Another seal portion is compression portion 90A. For use with glass vessels, a feature is that the seal structure is configured to absorb the greater flatness variability in the sealing area or surface of the glass vessel. The spring portion 90B of the seal structure is configured to flex easily to absorb the variability of the vessel seal surface, while the compression portion 90A extends below the skirt portion by a sufficient distance to compress in response to latch closure and provide adequate latch retention force to hold the lid latches in the closed position. The flexing of the spring portion is illustrated in FIGS. 2B and 2C, in the case of a glass vessel 60 with the lid 70. FIGS. 9B and 9C illustrate a plastic vessel with the lid 70.

In an exemplary embodiment, the spring seal portion 90B is a finger-like protrusion, angled inwardly toward the interior portion of the lid. In other embodiments, the spring seal portion may be angled outwardly, away from the lid interior. Other suitable configurations for the spring portion may be employed, such as a rib downwardly extending from the compression portion, or an elbow-shaped cross-section configuration. Exemplary dimensions of the spring portion for one embodiment are a height dimension on the order of 0.04 to 0.05 inch, and a thickness of 0.025 to 0.040 inch. Exemplary dimensions for the compression portion are a thickness of about 0.10 inch and a height varying from about 0.085 to 0.15 inch, depending on the location around the perimeter. An exemplary overall height dimension for the seal structure is 0.35 inch, for an exemplary embodiment.

FIGS. 8A-10B illustrate another vessel and lid system 50-1, in which the lid 70 is used in combination with a plastic vessel 60-1. The vessel 60-1 is a unitary structure, having an open top region 60-1-1A, defined by a bottom portion 60-1-2A, a sidewall portion 60-1-2B and a peripheral rim portion 60-1-4. In this example, the sidewall portion 60-1-2B is angled outwardly from the bottom region, defining an 8 degree angle relative to the bottom portion, which is typically variable for different vessel sizes and configurations. This particular angular arrangement is but one example, other configurations of the sidewall and bottom portions of the vessel may alternately be employed. The rim portion 60-1-4 includes a generally flat top edge portion 60-1-4A and a latch engagement lip portion 60-1-4B.

The lid latching and sealing structures interact with the vessel 60-1 in a manner similar to that described above regarding the glass vessel 60. The flat top edge portion 60-1-4A of the plastic vessel may be flatter than the corresponding seal surface of the glass vessel.

Another feature of a lid and vessel combination is the provision of a lid receptacle feature, configured to capture the base of a vessel in a stacking arrangement, without utilization of special features on the vessel base. The stacking is illustrated in FIGS. 7A and 7B for a glass vessel 60, and in FIGS. 10A-10B for a plastic vessel 60-1.

5

The receptacle feature of the lid **70** is illustrated, for example, in FIGS. 3A-3C. The inner wall **72-2** and lid web portion **72-5** connected to the inner wall define a recess or receptacle region **76**. The receptacle region has a depth **D3**. The top edge **72-2A** of the inner wall **72-2** defines a closed generally rectangular periphery **P** (FIG. 3A). However, the periphery **P** in the areas intermediate the lid corners is defined by length dimension **D1** and width dimension **D2** which are somewhat smaller than the same length dimension measured at the corners of the lid. The inner wall **72-2** may be vertical or inclined inwardly at the intermediate regions. The dimensions **D1** and **D2** are selected in combination with the dimensions of the base of vessels such as **60** and **60-1**. In the case of glass or ceramic vessels, the lid is designed with enough clearance to allow the glass vessel (such as vessel **60**) to enter and sit in the receptacle without interference. In the case of a plastic vessel, such as vessel **60-1**, the lid is designed to create an interference fit between the periphery **P** and the side walls of the vessel when the vessel is placed over the receptacle **76** and pressed down into the receptacle. In the case of a plastic vessel, both the vessel base and the lid wall may flex sufficiently to allow the vessel base to be seated in the receptacle **76**.

This lid-vessel stacking may be employed to stack two or more of the vessel-lid systems while securely preventing lateral movement of an upper system relative to a lower system. Moreover, this can be achieved without special features in the base of the vessel. The vessel walls adjacent the base may be vertical or closer to vertical in the areas of interference with the lid, and with the angle relative to vertical increasing above the areas of interference.

Another feature of an embodiment of the lid **70** is the capability of lid nesting of multiple lids with interference fit between adjacent lids to lock the lids together. FIGS. 11A-11C illustrate two lids **70** stacked together. The outer skirt **72-3** of the lid **70** in the lid corners has a step or shoulder **72-3A**, such that the lower portion **72-3B** below the shoulder can be fitted over the outer skirt of another lid **70** and rest on the shoulder **72-3A** of a lower lid in the stack. FIGS. 3C and 6C show the construction of the lid skirt in the corner regions. The skirt dimensions are selected such that there is an interference fit between the interior wall surface of skirt portion **72-3B** and the outer wall surface of the skirt above the shoulder of a nested lid **70**, to provide a frictional engagement between the respective lids. The interference dimension may be on the order of 0.010 inch for one exemplary embodiment, but the interference dimension may be different for other embodiments and applications. The interference may secure the lids in the nested configuration, thereby enhancing storage and shipping of lids.

While the exemplary embodiments of the lids and vessels have heretofore been described with respect to rectangular configurations, the features and aspects may be utilized with other configurations. For example, FIGS. 12A-12C illustrate two nested lids designed to fit vessels having a circular footprint configuration.

The lid **70** is designed for sealing attachment to vessels with a range of dimensional tolerances. The vessel rim as noted above includes a generally flat top rim surface, for example **64** (FIG. 2E). The top rim surface may be designed with a downward sloping outer edge portion **64A2**. The inner edge portion **64A1** is preferably flat. Thus, moving away from the center of the lid, there is a downward slope of the surface **64A**. This downward slope accommodates some misalignment of the lid to the vessel, and also some vessel tolerances, in regard to latching force. The latching force is determined by how much the seal compresses when the latches are closed.

6

If the position of the latch hinge on the lid moves outwardly relative to the vessel rim, this would tend to increase the distance from the hinge to the vessel latch surface, and hence the latching force. However, the slope of the rim surface on the outer part of the rim allows the lid to move downwardly, so that the distance from the hinge to the vessel latch surface remains the same, or at least reducing an increase in this distance. The slope or curvature thus tends to reduce variations in the latching force due to vessel dimensional tolerances.

In another embodiment, the sealing surface at the rim of the vessel may be designed with a slight slope downwardly from the center of the sealing surface toward the center of the lid, as well as a slight slope downwardly in a direction away from the lid center. This embodiment can accomplish the same benefit in reducing variations in latching force whether the lid periphery is shifted inwardly or outwardly, either as a result of misalignment or manufacturing tolerances. FIGS. 13 and 13A illustrate this feature, in relation to a plastic vessel **60-1'** with top rim **60-1-4'** and sealing surface **60-1-4'**. Here, the midpoint of the sealing surface is the highest point of the surface relative to the vessel base, and the sealing surface slopes downwardly in either direction from the midpoint.

Although the foregoing has been a description and illustration of specific embodiments, various modifications and changes thereto can be made by persons skilled in the art without departing from the scope and spirit of the invention.

What is claimed is:

1. A lid for attachment to a vessel having an open top surrounded by a peripheral edge portion, the lid comprising:
 - a lid portion fabricated of a plastic material, and a peripheral seal structure portion formed of an elastomeric material different from said plastic material of the lid portion, the seal structure portion integrated with the lid portion to form a unitary one-piece lid-seal structure wherein the seal structure portion is permanently attached to the lid portion;
 - a set of latches integrated with the lid portion;
 - the seal structure portion comprising a main body portion attached to the lid portion, a second seal portion comprising a protruding spring portion, and a third seal portion comprising a compression portion at a distal end of the seal structure portion, the spring portion of the seal structure when viewed in cross-section comprising a finger-like protrusion protruding from the compression portion at said distal end, and wherein the spring seal portion is angled inwardly toward an interior portion of the lid or outwardly away from the interior portion of the lid and angularly away from the distal end with the lid in an unattached position relative to the vessel, wherein the seal structure portion extends about an entire outer periphery of a peripheral channel portion of the lid portion, the spring portion configured to flex as it is brought into contact with and to maintain sealing contact with the vessel sealing surface portion to absorb flatness variability of the vessel sealing surface portion, while the compression portion is configured to contact the vessel sealing surface portion and compress in response to latch closure and to provide adequate latch retention force to hold the lid latches in a closed position; and
 - wherein the seal structure is configured to provide an airtight seal between the lid portion and the sealing surface portion of the peripheral edge of the vessel when the lid is attached to the vessel.
2. The lid of claim 1, wherein the plastic material is polypropylene, and the elastomer material is a thermoplastic elastomer material.

7

3. The lid of claim 1, wherein the seal structure material is a material adherent to the lid portion plastic material, and wherein the seal structure portion is fabricated as an injection molded second shot onto the lid portion.

4. The lid of claim 1, wherein the protruding spring portion defines a flexible peripheral flap which bends as the lid is placed in position on the vessel and the flexible flap comes into contact with the sealing surface portion of the vessel, and is bent upwardly as the lid is latched.

5. The lid of claim 1, wherein the peripheral channel portion is defined by a peripheral outer skirt portion of the lid portion and an inner peripheral wall structure connected by a web portion, and wherein the compression portion of the third seal portion extends below the outer skirt portion by a sufficient distance to compress in response to latch closure and provide adequate latch retention force to hold the lid latches in latched positions.

6. The lid of claim 1, wherein the lid is configured to attach to different vessels of different constituent materials to provide an air-tight seal, and wherein the different constituent materials include glass, ceramic, metal and plastic, whereby the lid attaches to a glass vessel to provide a first air-tight container system, to a plastic vessel to provide a second air-tight container system, to a ceramic vessel to provide a third air-tight container system, and to a metal vessel to provide a fourth container system.

7. The lid of claim 1, wherein each of the set of latches is connected by a living hinge to a peripheral outer skirt portion of the lid and has latch hook features which engage a latch engagement lip portion of the vessel when the lid is placed on the vessel and the latch is rotated about the hinge to a latched position.

8. The lid of claim 7, wherein each of the set of latches is recessed relative to adjacent areas of the peripheral outer skirt portion of the lid so that the latch and hinge do not protrude outwardly from the adjacent areas to provide protection against damage to the latch.

9. The lid of claim 8, wherein the lid has a rectilinear configuration with four linear sides, the set of latches includes four latches, one latch along each linear side, and wherein the adjacent areas of the peripheral outer skirt portion are at corners of the lid.

10. The lid of claim 1, wherein the lid has a rectilinear configuration with four linear sides, and the set of latches includes four latches, one latch along each linear side.

11. A vessel and lid combination, comprising:

a first vessel having an open top surrounded by a peripheral edge, wherein the vessel is a unitary structure, having an open top region, a bottom portion, a sidewall portion including a peripheral rim portion defining a top seal surface portion and a latch engagement lip portion at or adjacent the open top region;

a lid for covering the open region and including:

a lid portion fabricated of a plastic material, and a peripheral seal structure portion formed of an elastomeric material different from said plastic material of the lid portion, the seal structure portion integrated with the lid portion to form a unitary one-piece lid-seal structure wherein the seal structure portion is permanently attached to the lid portion;

a set of latches integrated with the lid portion;

the seal structure portion comprising a main body portion attached to the lid portion, a second seal portion comprising protruding spring portion, and a third seal por-

8

tion comprising a compression portion at a distal end of the seal structure portion, and wherein the seal structure is configured to absorb flatness variability in the seal surface portion of the vessel, the spring portion of the seal structure protruding from the compression portion at the distal end, the spring portion comprising a flexible flap extending toward an interior portion of the lid or outwardly away from the interior portion of the lid with the lid in an unattached position relative to the vessel, wherein the seal structure portion extends about an entire outer periphery of a peripheral channel portion of the lid portion, the flap configured to flex as it is brought into contact with and to maintain sealing contact with the top seal surface portion to absorb variability of the vessel top seal surface portion, while the compression portion is configured to provide adequate latch retention force to hold the lid latches in a closed position; and wherein the seal structure is configured to provide an air-tight seal between the lid portion and the top seal surface portion of the peripheral edge of the first vessel when the lid is attached to the first vessel.

12. The combination of claim 11, wherein the seal structure of the lid is configured to compensate for sealing surface variability of a plurality of different vessels each fabricated of a material different from materials of others of the different vessels, so that the lid is attachable to each of the vessels of the different materials to provide an air-tight seal.

13. The combination of claim 12, wherein the plurality of different vessels includes a glass vessel, a plastic vessel, a ceramic vessel and a metal vessel.

14. The combination of claim 11, wherein the peripheral rim portion includes a downward sloping outer edge portion extending outwardly from a central region of the peripheral rim portion to accommodate effects of some misalignment of the lid to the vessel and reduce variations in latching force.

15. The combination of claim 14, wherein the peripheral rim portion includes a downward sloping portion extending inwardly from a central region of the peripheral rim portion to accommodate misalignment of the lid to the vessel.

16. The combination of claim 11, further comprising a second vessel, the second vessel formed of a second material different from a material of said first vessel, and said lid is configured to attach to each of said first vessel and said second vessel with an air-tight seal, the seal structure configured to accommodate flatness variability in the sealing area or surface of each of said first vessel and said second vessel.

17. The combination of claim 16 wherein said material of said first vessel is glass and said second material is a polymeric material.

18. The combination of claim 11, wherein the lid include a lid receptacle, configured to capture a base of the first vessel in a stacking arrangement, without utilization of special features on the vessel base, wherein side wall portions of the vessel are substantially vertical at interference areas adjacent a bottom wall portion of the first vessel, and wherein the receptacle is defined by an inner wall and a lid web portion, and wherein a top edge of the inner wall defines a closed periphery, said periphery in selected areas defined by dimensions selected in combination with corresponding dimensions of the base of the first vessel to create an interference fit between the periphery and said interference areas of the side wall portions of the first vessel when the first vessel is placed over the receptacle and pressed down into the receptacle.

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